# L25.01 Flowchart Design and Use

What is a Flowchart?

- A Flowchart is a diagram used to visually explain a work process in a simple step by step image.

- Flowcharts are used in multiple fields.

- They can be tailored to intended audience
  - Technical or simplistic.
  - Very detailed or a basic overview

Uses of a Flowchart

- A visual representation of a sequence of operations
  - Detail a step-by-step method of work
  - Demonstrate decision making process of a task

- Visual guide to software operational design
  - Plan out the entire software layout of a project
  - Explain data flow and data collection steps
  - For LaACES we will be often use them in this context
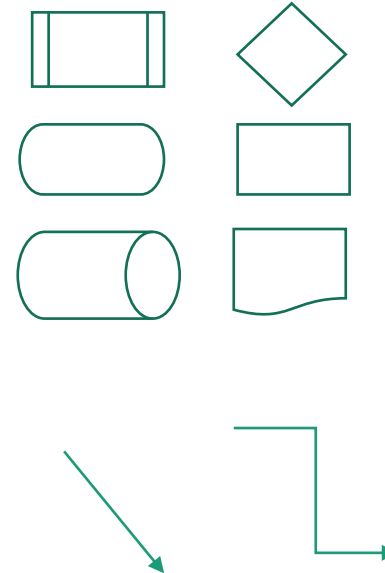 - Use them to plan out how your software will work PRIOR TO writing your code
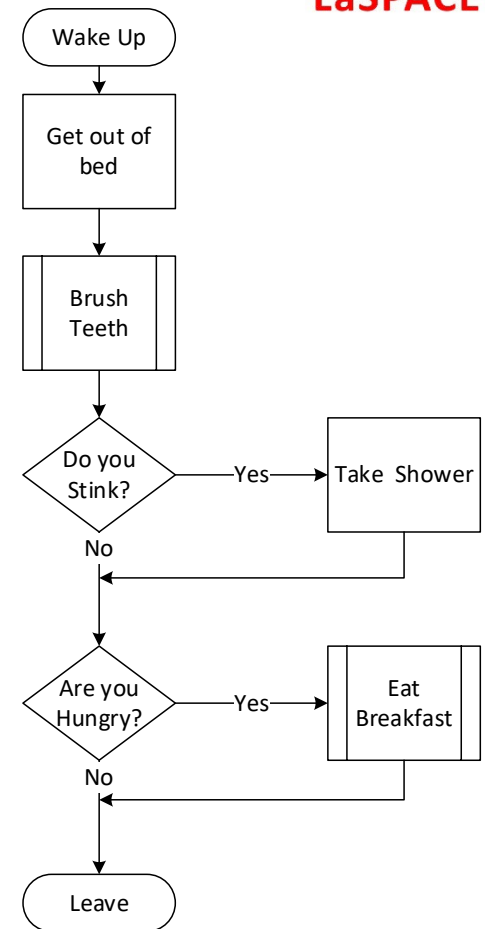
Basic Components of the Flowchart

- Flowchart is made of 2 basic components
  - Symbols and Connector

- Symbols
  - Detail type of action being preformed
  - Location of data flow
  - Destination of information

- Connector
 - Details the logical flow of the system

Main Flowchart Symbols

- ## Start/Stop System
  - ### Identifies the beginning and the end of a process

- Process Symbol
  - Identifies a controlled event in the process

- Decision Symbol
  - Identifies an action requiring a choice
  - Usually requires a yes or no response branch

- Subprocess Symbol
  - Denotes a subprocess defined elsewhere
  - Can be called multiple times anywhere
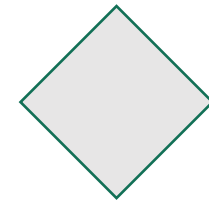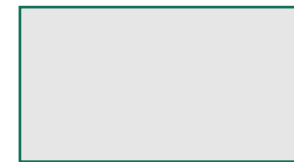
Start and Stop

- Indicates the point at which we enter a program or subprocess

- A good point to document any initialization that occurs

- The stop indicates where a program either finishes and stops, or where a subprocess returns to program that called it.

- Should be only one Start

- Multiple Stops are possible

Process Symbol

- Should be used to denote a step of a program that accomplished one operation

- If we want to show something that would be more complex and require several steps, instead we would use a subprocess

- Think of it representing a single line of code that performs one operation

  - Increment counter c+1
 - Read analog pin A1

- Should only have single arrow exiting it
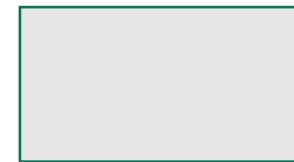
Decision Symbol

- This corresponds to any sort of logical evaluation that occurs in program
  - If … statements
  - Checking to see if a loop should continue

- Only type of block that should have multiple arrows leaving it

- Each branch leaving it should have clearly defined condition for when that path will be taken
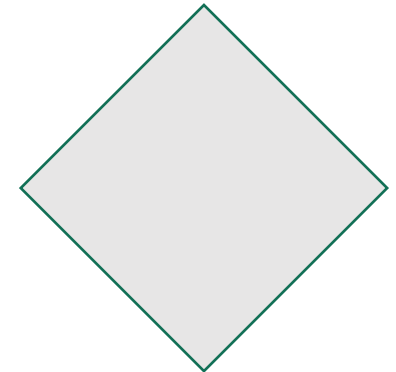
Subprocesses

- Subprocesses are similar to subsystems in system drawings

- These accomplish more complex operations but allow us to make a simpler diagram

- There should be another flow chart that documents what the subprocess does in detail

- Those subprocess should have their own start and stop blocks showing where the process is enters and when it returns

- Correspond to functions you call with within a program

Arrows

- Unlike system drawing arrows should be one way (program does not go backwards)
  - Arrows can point back to early points of the flowchart like when we go back to the start of a loop
- Block can have multiple arrows leading into them
  - You can enter the loop() function of an Arduino both
- Only decision points should have multiple arrows pointing out from them
  - The program can only do one thing at a time so must proceed on to the next step, if there are multiple possible next steps some decision has to occur which way it proceeds
- Avoid crossing arrow lines because this ambiguous and unclear

Designing your Flowchart

- Define your reason and scope
  - What is the purpose of the process you are documenting
  - What is the ultimate goal of the process
- Identify your tasks
  - Document all tasks in your process
  - Identify the required steps to complete the task
- Layout the flowchart
  - Layout all tasks in their logical order
- Test the flow of your design
  - Verify that the end point of the process produces your documented goal
- Make sure your flowchart is readable
- If necessary, break across multiple charts or pages
  - Just indicate where you leave one and enter the next

Flowchart Software

- Flowcharts being similar to system designs we can use the same software

- This means Visio, Google Drawings, Draw.io or similar software